Next-Generation Measurement Architecture
Standardization and Outreach Group (NMASOG)
Architecture Standards and Specifications

Background

The Federal Communications Commission undertook in 2010 a collaborative effort with industry, academia and consumer advocates to provide a comparative analysis of consumer broadband performance in the United States. This program, *Measuring Broadband America (MBA)*, has proven formative in a number of respects. First, it has provided a collaborative environment to discuss the proper metrics and methodology to measure consumer broadband performance. Second, it has helped to outline some of the fundamental building blocks for a data collection infrastructure to support the collection of broadband performance data. Third, it has served to demonstrate the high level of interest in statistically valid performance data to the consumer, to policy makers, to the academic community and to Internet service providers themselves. Finally, it has served to outline the limitations inherent in the current program which remains focused on national level results. (A full description of the *Measuring Broadband America* program can be found at our website on http://www.fcc.gov/measuring-broadband-america).

While the program has proven valuable in providing the first statistically reliable broadband performance data for service providers supporting over eighty percent of the nation, inherent limitations in the present approach curtail the ability to scale the program. The program infrastructure is implemented as an add-on network with client devices installed at consumer households and measurement end points implemented discretely in the network. Approximately 9,000 households are involved in the current effort, sufficient to provide statistically valid results on a national level. However, providing data on a metro level of granularity would require test data from perhaps 100,000 to 200,000 households. This would require a proportional scaling of client devices for the household and network measurement end points making the current approach untenable. To scale the program to this level requires a different approach. We believe that developing open standards within a diverse community of interests will allow more efficient implementations to be developed over time.

Discussions by the FCC with equipment providers and Internet Service Providers over the past few years have suggested that a standards based approach is both technically feasible and can serve multiple interests. Discussions with ISPs have suggested that a consumer performance testing capability is of interest to ISPs in order to manage service assurances to the end users, to identify whether service issues are related to network performance or to issues within the consumer household and to help lower overall support costs associated with the end user. Discussions with some modem manufacturers and network router vendors have evidenced that testing capabilities similar to those used in the MBA program are being contemplated to improve overall diagnostic capabilities or that such capabilities are easily with the scope of planned equipment.

The FCC will continue to support a policy of openness and transparency for its Measuring Broadband America Program as it evolves. Any standard supporting an FCC-sponsored measurement program would need to be implementable in line with the following tenants. These are requirements that will guide any FCC implementation of any measurement standard, and as such are instructive as a guideline for future use in this forum and any other related measurement standardization efforts.

1. Measurement infrastructure will be openly documented, and extensible with results verifiable by third parties.
2. The measurement methodologies will be openly documented and implementable by third parties.
3. All data collected for the purposes of the Measuring Broadband America program will be made publicly available, in its raw, unaggregated form. The data collected must be suitable for full, public release.
4. Any analytic methodologies applied to the data after collection to achieve published statistics will be made publicly available.

Standards Proposal

We believe that standardization of end-user focused Internet service performance would both serve the interests of Internet Service Providers as well as the interests of the FCC, and other interested parties such as academia. Standardization is also required if the costs of collecting such data are to be reduced, allowing the potential to increase the number of participating ISPs as well as the scope of the data collected. This standardization effort needs to proceed on two fronts; a standardization of the metrics and methodology used to characterize performance and a standardization of the data collection infrastructure that permits performance tests to be run and the results collected for further analysis.

We have had informal discussion with the IETF regarding their possible role in standardizing metrics used to characterize broadband performance and intend to submit a request to the IETF to undertake a work program towards this end. We believe that the data collection infrastructure also requires standardization and are submitting this proposal to the Broadband Forum to begin a work program to this end. It is our present understanding that this proposal would match the objectives of the Broadband Access Service Attributes and Performance Metrics (WT-304) work program and would be appropriate for submission to this work group.

Data Collection Infrastructure Goals

We discuss below a number of goals for a standards based data collection infrastructure.

End to End Model

The standardization effort should support an end-to-end model spanning from the end user to the application provider, though implementation of a specific data collection infrastructure may encompass only a portion of this model. For example, the current MBA program measures the performance of a consumer's Internet Service provider, from the consumer's modem to the closest Internet egress point for the service provider's network. This may be a natural domain for implementation of a data collection infrastructure. However, the standards should support inclusion of data test end points to include any desired point in an end to end model. Simply, the standards should support end-to-end measurements and integration into a broader, open infrastructure even if specific implementations may measure only a portion of an end-to-end model.

Comparable Results

The standards should support data measurement and collection that would allow consistent, comparable and independently verifiable test results across a range of service providers and different technologies. Test methods and methodologies should therefore be fully documented.

Adaptability

The standards should support a variety of physical implementations allowing the greatest degree of freedom in implementation. For example, the same standards should support implementation of a stand-alone client device or a client integrated within the modem terminating broadband service to the consumer. Similarly, a network test node could be implemented in a stand-alone server specific to that purpose or integrated within an existing network element such as a router. It is important that the requirements not be prohibitive. For example, implementation of an open standard should not require ownership of the network infrastructure itself and the standards should be implementation neutral. In addition, though the initial MBA effort was focused on Wireline services, the FCC is considering a similar effort on wireless services. Standards should support adaptability of infrastructure to support services such as mobile broadband wireless, as well as Wireline services.

Scalability

Standards should support scalability of architecture allowing consumer end points to range from the thousands to the hundreds of thousands or even millions of consumers.

Multiuser Support

We have already noted two distinct users associated with the collection of network performance data. Internet Service Providers may operate a data collection infrastructure for their own purposes such as obtaining network performance data or supporting customers. Regulatory bodies such as the FCC may also wish to specify tests and obtain results such as used in the MBA program for policy and consumer information purposes. Other entities such as academic institutions may, at times, be involved in the process of collection of Internet performance data. This raises issues of operation and control. How are tests scheduled? How is access to data obtained? What security and control features need to be defined to ensure the network is protected? What audit and verification procedures need to be in place to ensure integrity of testing?

Multiuse

Standards should support use of the data collection infrastructure for multiple purposes. As noted, an ISP may wish to obtain performance data associated with its network solely for its purposes perhaps running customized test scripts. Alternatively, an ISP may wish to use this infrastructure for customer support, providing tools that may, in fact, be customer initiated to assist the customer in determining the functioning of his service. In addition, use of this infrastructure may be permitted to support a wider scope effort providing comparative data associated with a regulatory collection effort. Standards should support the widest adaptability of use for different purposed and parties.

Consumer Privacy

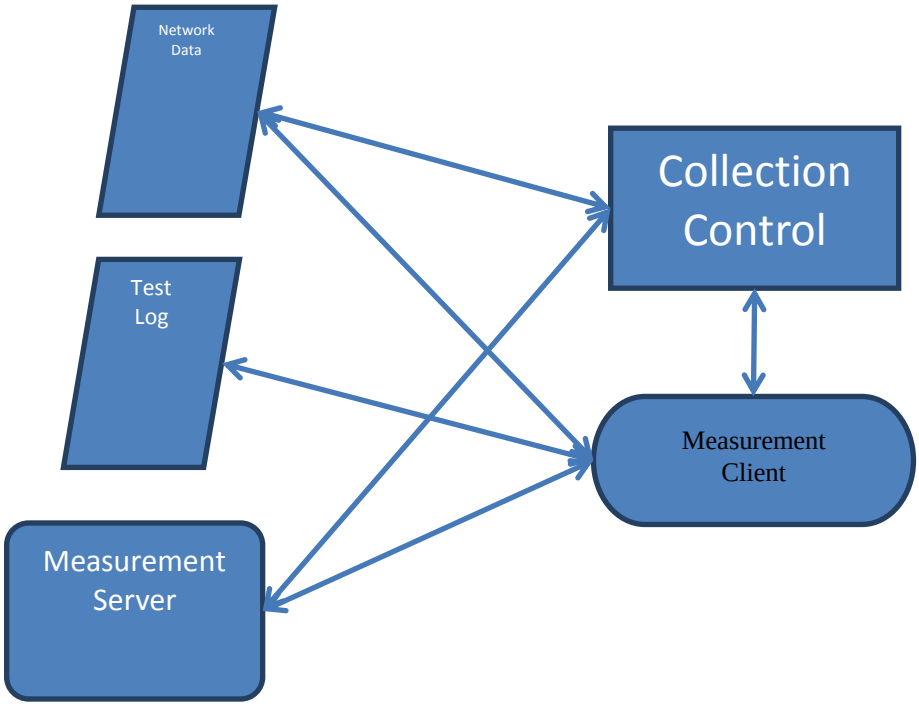
The interest of all parties involved in this effort has been to ensure that data collected is purely network data and does not include any Personally Identifiable Information (PII) in any form. Standards specifications must reflect this requirement.

Reasonable Timeframe for Implementation

Discussions with equipment vendors suggest that there is a natural trend in the direction of more service specific and end-user focused testing capabilities. It is an implicit goal to leverage this activity and minimize overall cost. We would expect that specific technology recommendations would be guided by the vendor community's timelines and product plans.

Conceptual Architecture

Based on the experience we have gained during the evolution of the MBA program, we offer a conceptual architecture to both focus discussion and outline general requirements. We emphasize again that the scope of data collection should conceptually extend from the end user, including the end user's home environment, to the application service provider, a full end to end view with the flexibility to establishment measurement points between network paths where of interest.



Measurement Client

- Receives schedule of tests, test scripts, and target test servers
- Performs tests and stores results as directed
- Transfers data to Test Log periodically
- Registers with Network Data server when activated

Measurement Server

- Receives test scripts associated with Measurement Client Tests
- Registers availability and other information with Network Data server
- Can be implemented as stand-alone or integrated device
- Can be implemented at any point of interest for testing

Network Data Server

- Contains list of active clients, client location, client service data, access technology, provisioned speed, etc.
- Contains list of measurement servers and contextual data

Test Log

- Contains results of tests that are run organized by test program id (test may be run for different purposes: customer support, regular reports, special reports, etc.)

Collection Control

- Controls scheduling of tests
- Controls access to test data
- Controls requests for testing
- Downloads test scripts to measurement clients and measurement servers
- Collection and Control may be nested with a higher order control system receiving infrastructure data from and directing a lower order control system to initiate test.
- Security should provide assurance that infrastructure elements cannot be used for malicious purposes

Summary

The FCC's Measuring Broadband America program has provided an opportunity for the FCC to work collaboratively with industry and others on a program to provide broadband performance data in an open and transparent process. Standardization of this work effort is another step in this policy, ensuring that characterizations of broadband performance are openly specified and widely supported. We expect that such performance data will be used increasingly both to gauge overall progress of broadband evolution in the United States and to support other interests as well. We believe a standardization of both the metrics and collection infrastructure would benefit all in terms both of affording an efficient mechanism for the collection of such information and ensuring that the metrics employed are well founded, providing comparable results across networks and service providers. We therefore ask that the Broadband Forum undertake this proposal.